LIGHTNING – Facts, Myths and Misnomers

The question "How likely am I to be struck by lightning?" is a seemingly simple question to answer, but it's not a one fits all condition. The average annual per capita strike rate in the United States is around 1 in 600,000. This ***DOES NOT*** mean your odds of being struck are 1 in 600,000.

Overall, a rate of 7.7 casualties per million people per 100 million flashes was found for the entire United States.

The odds of being struck vary considerably across the nation and can be influenced by a number of factors, including:

1) Geographical location and climatology
2) Diurnal and annual climatology
3) Personal lifestyle/hobbies

In those areas where a lot of lightning strikes occur, there is an increased chance of being struck. The area from Tampa Bay, FL to Titusville, FL (a.k.a. "Lightning Alley") receives the most lightning in the United States on an annual basis. More than 90% of the lightning in this area occurs from May through October, between the hours of noon and midnight. During this time of day and year, people in Central Florida who spend a large portion of their lives outdoors (e.g. construction workers, park rangers, golfers, campers etc.) are much more likely to be struck than anytime or anywhere else in the country. On the other hand, thunderstorms are uncommon in the Pacific northwest, and are virtually unheard of during the winter months. People in this region who spend much of their lives indoors (e.g. shopkeepers, librarians, bowlers, billiard players, etc.) might win the lottery before they were struck by lightning. It is simply impossible to assign one single probability to every person.

Another frequently asked question is how far away is the lightning?

The ***FLASH to BANG*** method provides a best guess estimate:

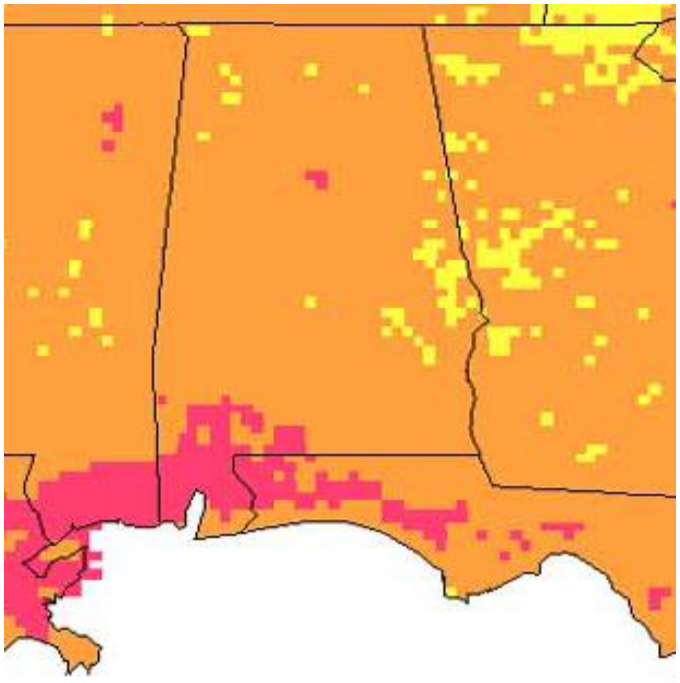
1...When you see the **FLASH**
2...Count the number of seconds to the **BANG** of thunder,
3...Divide this number by 5,
4...And this gives you the MILES the lighting is away from you.

http://www.srh.noaa.gov/mlb/?n=lightning_facts for the full accounting.

The latest National Weather Service lightning safety recommendation is to seek shelter immediately upon hearing thunder, regardless of your direction and distance from the thunderstorm.

More Flash than Bang

The Flash to Bang method is an approximation of the speed of sound associated with lightning. The fact is sound travels differently through differing mediums. The speed of sound travels through dry air, at 68 degree Fahrenheit, at 1 mile per seven seconds. Sound travels through water considerably faster than dry air. The widely varying air densities in the atmosphere, influenced by variable temperatures and moisture content, will enhance and retard sound travel. It is this variation in air density through which the sound of thunder travels that accounts for the rumble of thunder. Keep in mind that the five second rule is an empirical figure and should be used only as a guide; as a best guess estimate



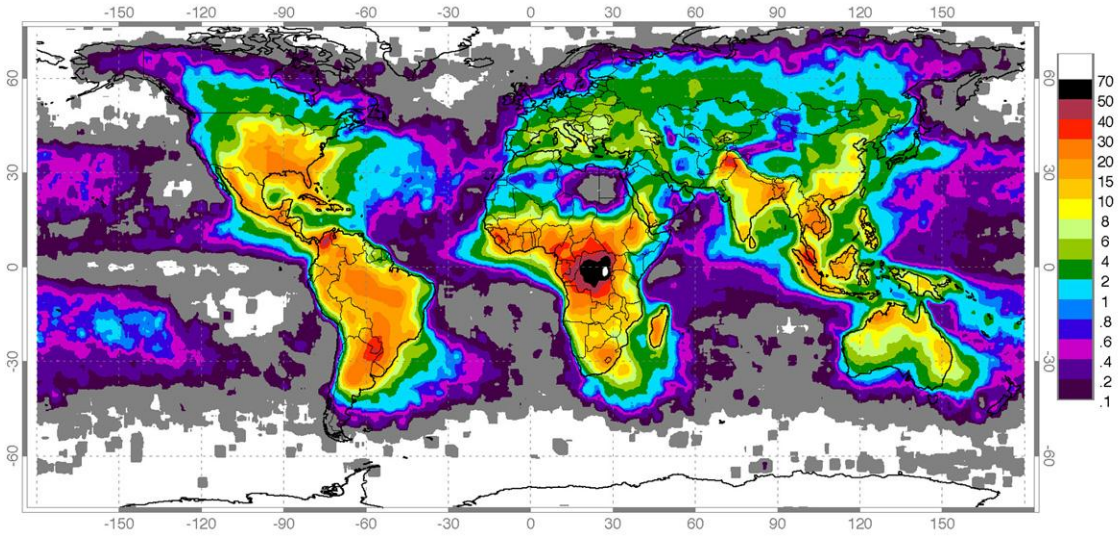
The above image depicts an assessment of lightning occurrences during the 1996-2000 time period. The red shaded areas indicate 8-16 flashes per square kilometer per year, on average. The higher occurrences along the Florida panhandle to Southeast Louisiana are attributed to thunderstorm development along the Sea Breeze Front. Map provided by Vaisala GAI.

Negative Polarity

A negative lightning strike is the result of the buildup of negative electrons at the cloud base from which the majority of lightning is drawn or released. A high electron count at the base of thunderstorms results in a high proton count within the high anvil thunderstorm top. Subsequently, the heavy negative charged cloud bases become strong enough to repel electrons on the earth surface resulting in a buildup of surface based positive energy; and a positive proton leader is formed from the ground up. Theoretically, areas of higher positive ground level surface energy will result in more cloud to ground lightning occurrences.

Thunderstorm Lightning Distribution

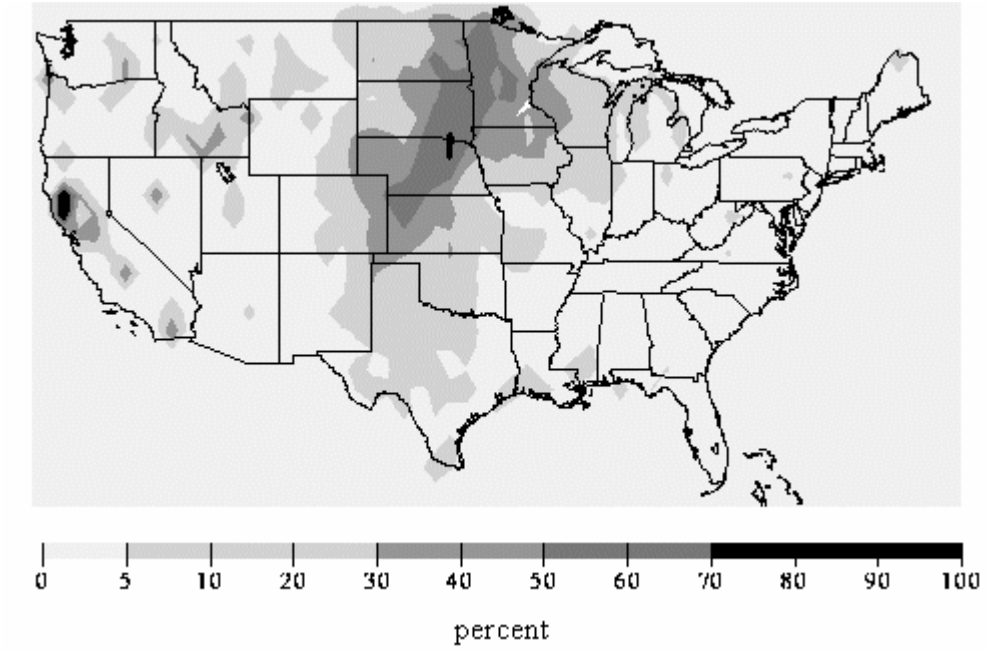
The worldwide lightning mapping might suggest greater positives energies across the breadth of the Southeastern U.S.; and, apparently there's a whole lot of positive vibes going on in Central Africa as well. However the correct conclusion should be that of a far greater number of thunderstorms occur over land masses, and more so over those sections having the necessary heat, humidity, and greater instability.



Positive Polarity

On the other hand, empirically a higher rate of or the sudden increase in positive cloud to ground lightning strikes is associated with a severe thunderstorm potential. The several studies including: Branick and Doswell 1992, Curran and Rust 1992, Seimon 1993, MacGorman and Burgess 1994 and Stolzenburg 1994, all support the premise that higher positive strikes lead to severe weather. The MacGorman and Burgess (1994) study determined the majority of storms dominated by positive cloud to ground (CG) lightning produced tornadoes. Those storms which produced the most damaging tornadoes began after the positive CG flash rates dropped from their peak value and before or near the time when negative CG lightning became dominant. The RJ Kane 1991 study stated the development of

tornadoes and/or large hail followed the peak in the 5-minute lightning rates by 10 to 15 minutes; that there occurred a rapid decline in CG strikes and a polarity shift occurred thereafter. http://www.nwas.org/ej/pdf/2002-EJ2.pdf for the expanded accounting.



Map showing percentage of large hail and tornado reports associated with PSD storms. Dominant polarity is calculated using CG lightning data during the hour around severe weather. SPC reports were analyzed from April – September 1989-1998. Figure from Zajac et al (2002), which was adapted from Carey et al (2003).

Positive strike dominated (PSD) storms were most prevalent over areas of lower dew points and with the occurrence of low precipitation (LP) supercell storms. In the case of LP supercell storm development in Alabama, a watch full eye on the switch to a negative strike dominated (NSD) supercell should signal resultant heavy precipitation fallout.

Flash Rate Jump

A thunderstorm lightning study, conducted by the Melbourne Florida WFO, has shown severe thunderstorms to be associated with continuous lightning frequency. Wherein, typical severe thunderstorms produced a jump in flash rate of 20 FPM over a 6 to 7 minute time duration. The greater importance of this study is that of flash rate jump in association with severe thunderstorms. It was discovered that a sudden flash rate jump was the prelude to severe weather occurrences. The FPM jump was of relative short duration in comparison with the total life cycle of the average thunderstorm cell; although, long lived severe thunderstorms presented numerous jumps over their life cycles. It was further concluded that lead times on severe thunderstorm warnings could have been increased by an additional 8 minutes had the jump signal been recognized and acted upon more readily. See http://www.srh.noaa.gov/media/mlb/pdfs/summer_lisdad1.pdf for the full Melbourne WFO study.

Popular lightning myths: http://www.lightningsafety.noaa.gov/myths.htm not the least of which is "heat lightning".

Heat Lightning

There are two possible exceptions to the rule; heat lightning is a misnomer. Atmospheric electrical static buildup arising from the casting upwards of massive amounts of charged dust particles can result in an electrical discharge. Outside of the electrically charged debris resulting from volcanic eruptions and massive updrafts from intense forest fires, heat lightning does not occur. That which is so very often called heat lightning, is actually emanating from distant over the horizon or otherwise unseen thunderstorms; from which no audible thunder is heard. The sound of thunder can be abated by terrain, or distance, or the sound waves can become inaudible due to atmospheric density bending of the sound wave. Wind and rain can also cause the dissipation of thunder sound waves. Now knowing the facts, the term may be knowledgeably used in the proper context; but it simply doesn't happen out of thin air.

Frequency Rate of Lightning Strikes

The term "severe lightning" is another often used but nonetheless invalid descriptor; as it would be impossible to differentiate the electrical power or energy of one lightning bolt from others. Here are some usual numbers associated with lightning bolts: 54,000 degrees F; 100 kiloAmperes (thousand); 1 gigavolts (billion); and 1 terawatt (trillion). The correct practice for describing lightning occurrences for the studious weather observer is to do so in the terms of its frequency rate. A rate of 1 to 3 flashes per minute (FPM) is that of an occasional nature; 4 to 11 occurrences per minute is known as frequent; and, equal to or greater than 12 strikes per minute (1+ every 5 seconds, over a full minute time duration) is regarded as continuous or sometimes as excessive. But, any more than a single terawatt lightning strike hitting the outhouse could readily be considered excessive, depending on occupancy. An empirical rule states that continuous lightning is often associated with a severe thunderstorm; and, is supported by the above flash rate jump study. Hence, properly noting the frequency of lightning strikes can provide insight into the severity of a thunderstorm.

Bottom Line

The foremost lightning safety message to remember is, "When Thunder Roars, Go Indoors". And when doing so, remember to refrain from use of home and office utilities that conduct electricity such as water sources and electrical appliances.